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NUTRITION AND EDUCATION

BY

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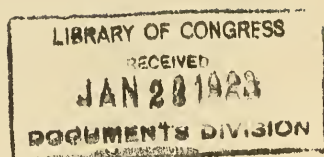
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NUTRITION AND EDUCATION.^a

By E. BLANCHE STERLING, Acting Assistant Surgeon, United States Public Health Service.

Two insistent questions arise in the minds of thoughtful parents everywhere: Shall I send my child to school as soon as the law says he is old enough to go, or would it be better for his health if I kept him out till he is older? If he seems brighter than the average child, will it be detrimental to his health to permit him to be "accelerated"—to make as rapid progress through the school grades as his teachers desire?

The answers to these questions, from both physicians and educators, have been usually merely an expression of opinion colored by the viewpoint of the person consulted. In view of the contradictory character of the data on which a reply to such questions might be in some measure based, and in order to study the subject in what might be called a fairly typical American community, the present investigation was made in the schools of a small city in the Middle West. This school system might be called a representative one, comprising three elementary schools, a junior high school, and a senior high school. The superintendent was a man of good professional training and progressive outlook, and many of his teachers were excellent. A very large majority of the pupils were of native American stock or of English, Scotch, or Irish ancestry.

Though it is believed that the relation between height and weight according to existing standards is not always a reliable index of the child's health, this criterion is used in these studies because no simple accurate measure applicable to large numbers is at present available. The arbitrary 7 per cent "line" was used to separate the children into two classes, those falling 7 per cent or more below the average standard of weight for height and age being considered under weight. In these studies the 7 per cent "line" is considered as a standard of attainment and possibly as an indication of poor physical condition on the part of the child that falls below it. From this standpoint it is felt that the comparative studies in this investigation will prove sufficiently suggestive to stimulate further research in the same subject.

In this investigation the results of the spring weighing rather than the fall weighing are used, because it is believed that the later weight serves as a better indication of the relation between health and school life.

^a Reprint from the Public Health Reports, Vol. 37, No. 45, Nov. 10, 1922, pp. 2798-2808.

A general survey of the school population showed that of 2,068 children weighed and measured in one of the spring months, 487, or 23.5 per cent, were under weight.

This underweight was distributed among the schools as follows:

TABLE I.—*Correlation of nutrition and periods of school life.*

School.	Number of children weighed.	Number under weight.	Percentage under weight.
Elementary (3).....	1,126	237	21.0
Junior high.....	520	124	23.8
Senior high.....	422	126	29.8

On the surface, these figures would indicate a moderate increase of underweight during school life. But such a conclusion would scarcely be justified without a fuller knowledge of growth and development during adolescence than can be derived simply from the height-weight-age index. Undoubtedly, as shown by the results of experienced estimation of nutrition by the Dunfermline scale and by critical study of the greater relative variation in weight in children with increasing age, other factors must be taken into consideration in estimating the physical fitness of all children and particularly of adolescents. It is generally believed that there is a greater amount of malnutrition among younger children than among older ones. An evaluation of nutrition by the Dunfermline scale, the use of which presupposes medical training and experience, has given results directly opposed to those shown in Table I, where the classification is based solely on height, weight, and age. In a study of nearly 10,000 school children made by the United States Public Health Service¹ there is shown a decrease in malnutrition from the younger to the older ages.

A statistical study² of anthropometric data collected by officers of the Public Health Service brought out the fact that relative variation in weight of children of given height increases appreciably with age. Since older children vary in weight more than younger, a 7 per cent line of demarcation is too restricted for the high-school age. With wider normal variations, the margins allowed for underweight and overweight must be greater.

A similar variation has also been observed by Baldwin.³

The data considered in the preceding discussion concern children of all ages for grade—the normal age for grade, the overage, and the

¹ Clark, Taliaferro: Nutrition in School Children. Jour. Am. Med. Assoc., vol. 79, No. 7, Aug. 12, 1922, pp. 519-524.

² Clark, Taliaferro, Sydenstricker, Edgar, and Collins, Selwyn, D.: Heights and Weights of School Children—A Study of the Heights and Weights of 14,335 Native White School Children in Maryland, Virginia, and North and South Carolina. Public Health Reports, vol. 37, No. 20, May 19, 1922, pp. 1185-1207. (Reprint No. 750.)

³ Baldwin, B. T.: The Physical Growth of Children from Birth to Maturity. University of Iowa Studies in Child Welfare, First Series, No. 50. Vol. I, No. 1, June 1, 1921. Iowa City, Iowa.

underage pupils. To shed some light on the problem of the most desirable age for the various periods of school life, it is necessary to study these groups separately. This part of the work was limited to the elementary and junior high schools.

Nutrition and Age for Grade.

ELEMENTARY SCHOOLS.

Normal-age-for-grade children.—Of 572 normal age for grade children in the elementary schools, 118, or 20.6 per cent, were underweight at the final weighing in March. Only 12, or 3.4 per cent, of the 346 children who were above the 7 per cent line at the beginning of school in the fall, fell to or below it during the school year. Apparently, only 3.4 per cent of these normal-age children were adversely affected by conditions during the school term, or by their school work.

On the other hand, 120, or 53 per cent, of the 226 children who were under weight on entering school in the fall went above the 7 per cent line during the year.

It might be stated that some nutrition work was carried on in the schools during this period, but this work was conducted quite irrespective of the age for grade status of the children. Since the effect of these measures will be felt in all groups, they may be largely disregarded in a comparative study of the groups.

Overage-for-grade children.—There were 465 overage for grade children in the elementary schools. Of this number 105, or 22.6 per cent, were under weight at the spring weighing. Of the 282 overage children who began the school year with less than 7 per cent underweight, 8, or 2.8 per cent, fell to or below that line during the year in school.

On the other hand, of 183 children underweight in the fall, 86, or 46.9 per cent, came up to the standard by the spring. As in the case of the normal-age children, the number gaining was vastly superior to the number losing during the school year. It is interesting to note that the ratio of loss to gain is so nearly the same in these two groups.

Underage-for-grade children.—The number of children under age for grade in any school will naturally be less than the number of either normal-age or overage pupils. The majority of children are sent to school at the normal age and advance at the normal rate, though large numbers, for one reason or another, are found among the overage-for-grade pupils. In the elementary schools studied there were 92 underage-for-grade pupils. Of this number 20, or 21.7 per cent, were underweight at the spring weighing. Fifty of these underage children were up to the standard of weight when they began school in the fall, and only 1 of them (2 per cent) fell below it during the period of observation. Of 42 underage children who were under-

weight in the fall, 23, or 54.7 per cent, could not be so classified in the spring, because they had come up to the standard.

In Table II the data relating to the elementary schools have been arranged for the purpose of easy comparison.

TABLE II.—*Correlation of nutrition and age for grade in elementary schools.*

Age for grade.	Number of children.	Per cent under-weight.	Per cent of under-weight children attaining standard of weight during period of observation.	Per cent of normal weight children falling below standard during period of observation.	Per cent taking milk lunch.
Normal age.....	572	20.6	53.0	3.4	70
Overage.....	465	22.5	46.9	2.8	52
Underage.....	92	21.7	54.7	2.0	69

It will be seen at a glance that the amount of underweight among the normal-age, overage, and underage pupils in the early spring is practically the same. From the standpoint of weight it seems evident that the year in the schools investigated was not detrimental to the health of the pupils; the descent into the underweight class among those who were not there in the beginning has been remarkably limited in extent.

The marked increase in weight in each group is probably due partly to the fact that the maximum increment takes place normally between October and February ⁴ and to the milk lunch furnished at the morning and afternoon recesses, in addition to some instruction in nutrition. Since school feeding is a recognized part of school hygiene and has been incorporated in the school system studied, this feature of the school life of this community should have equal consideration in relation both to the health of the pupils and to the school work. It is interesting, therefore, to note the close correlation between the percentage taking the milk lunch and the percentage showing weight increase during the year. Practically the same percentage of normal-age and underage children had the milk lunch at some time during the year, and the percentages of these two groups attaining the weight standard are almost the same. A considerably smaller percentage of overage children took the milk and a correspondingly smaller percentage of these children came up to weight during the year. It would be unfair to any school system to consider only the school side of the work and ignore all specific measures undertaken to safeguard the health of the pupils.

In order to gain some idea as to how far physical defects may have influenced the weight status of the pupils, a study was made

⁴ Porter, W. T.: Seasonal Variation in the Growth of Boston School Children. *Am. Jour. of Phys.*, May, 1920, vol. 52, pp. 121-131.

of physical defects in relation to age for grade. The results are summarized in Table III.

TABLE III.—*Physical defects and age for grade.*

Age for grade.	Average number of physical defects per pupil.
Overage.....	1.57
Normal age.....	1.44
Underage.....	1.41

A comparison of Tables II and III shows that among the overage-for-grade pupils there was slightly more underweight and a slightly higher average of physical defects per pupil. In other words, the overage pupils in the elementary schools were a little lighter in weight and had a slightly higher average number of physical defects per pupil than either the normal-age or underage pupils. These differences, however, are slight.

JUNIOR HIGH SCHOOL.

All of the seventh and eighth grade pupils, most of the sixth-grade, and a few fifth-grade children were taught at the junior high school by the usual methods in vogue at institutions of the same character. Most of the year there was considerable overcrowding at this school.

Overage-for-grade pupils.—There were 268 overage children in the junior high school, and 68, or 25.4 per cent, of this number were found to be underweight in the spring. One hundred and sixty of these children entered school in the fall in a well-nourished condition, and all but 5, or 3.1 per cent, maintained this position in the spring. Of the 108 children who were underweight at entrance, 45, or 41.6 per cent, came up to the required standard by the time of the spring weighing.

Underage for grade.—The number of underage children in the junior high school was small, only 56 pupils coming under this classification. Of these, 20, or 35.7 per cent, were underweight in the spring. One-half (28) of these underage children were up to the weight standard on beginning the school year, and all but one (3.5 per cent) held this position at the end of the year.

Of the other half of this group—those children who were underweight in the fall—9, or 32.1 per cent, came up to standard by the time of the spring weighing.

The data for supplying exact figures relating to normal-age children in the junior high school are lacking, but it is easy to see from the percentage of underweight of all the children in the school and from the figures for the overage and underage pupils that the per-

centage of underweight children among the normal-age children would be about 20.

TABLE IV.—*Correlation of nutrition and age for grade in junior high schools.*

Age for grade.	Number of children.	Per cent under-weight.	Per cent of under-weight children attaining standard weight during period of observation.	Per cent of normal weight children falling below standard during period of observation.
Overage.....	268	25.3	41.6	3.1
Underage.....	56	35.7	32.1	3.5

There were 90 pupils in the junior high school who had the milk lunch for varying periods during the school year, but their distribution as to age for grade is not sufficiently well known to be of use as a comparative factor. It may be said, however, that the correlation noted in the case of the elementary schools points to the influence of this feature in the weight increases.

The point of most interest in Table IV is the large percentage of underweight among the underage-for-grade children in the junior high school. Does this mean that the work of the junior high school is detrimental to the health of the *young* pupil, and that a child should not be allowed to enter that school unless he has reached at least the normal age for his grade? But reweighing in March showed that almost exactly the same percentage of overage pupils had fallen below the standard as underage pupils. In other words, the older children lost in exactly the same proportion as the younger ones.

A comparison of the gains in these two groups shows a larger percentage in the overage group; but since this is complicated by the question of extra nutrition, and since data regarding age-for-grade and milk lunches are incomplete, the comparison may not be a safe one. A reweighing in June would have been desirable, particularly in the junior high school.

Since to say that a child is underage for grade means that he has reached a certain school grade at an age younger than the normal, it usually means also that he is brighter mentally than the average child. May it be possible that these lighter-weight children at this particular age period are brighter than the heavier children? This is in contrast to the findings in Detroit ⁵ but agrees with those reported by the Bureau of Educational Experiments ⁶ with reference

⁵ Packer, Paul C., and Moehlman, Arthur B.: A Preliminary Study of Standards of Growth in the Detroit Public Schools. The Detroit Educational Bulletin, No. 5, June, 1921.

⁶ Hunt, J. L., Johnson, B. J., and Lincoln, E. M.: Health Education and the Nutrition Class. E. P. Dutton & Co., New York, 1921.

to the Terman classes. These classes were made up of exceptionally bright pupils from the sixth, seventh, and eighth grades (junior high-school grades) and contained a much larger percentage of underweight children than the regular sixth and seventh grades.

Nutrition and Acceleration.

The underage child is not necessarily the accelerated child. If a child begins earlier, he will reach a class before the normal-age child, though both travel at the same rate. The really accelerated child is the one who covers more ground in the same time. In this sense there were a number of accelerated pupils in both the elementary schools and the junior high school.

In the elementary schools there were 63 accelerated pupils,⁷ 27 per cent of whom at the last weighing were underweight. It will be recalled that the percentage of underweight among all the children in the elementary schools was 21. These exceptional children, with a percentage of 27, are lighter than the general run of children in the elementary schools. The age-for-grade and nutritional status of the group are shown in Table V.

TABLE V.—*Correlation of nutrition and acceleration in elementary schools.*

Age for grade.	Number of pupils.	Number underweight.	Per cent underweight.
All ages.....	63	17	27.0
Overage.....	15	3	20.0
Normal age.....	39	12	30.7
Underage.....	9	2	22.2

It will be seen from this table that the largest percentage of underweight is among the normal-age children and the least among the overage. The overage children are slightly heavier than the underage children in this exceptional group.

It was especially desired to ascertain whether the March weighing would show any unfavorable results as regards weight from the extra school work which these children had undertaken. The data on this question are presented in Table VI.

TABLE VI.—*Nutritional changes from October to March among accelerated children in the elementary schools.*

Age for grade.	Children gaining good nutritional status.		Children losing good nutritional status.	
	Number.	Per cent.	Number.	Per cent.
All ages.....	11	44.0	3	7.9
Overage.....	3	60.0	1	10.0
Normal age.....	6	37.5	2	8.7
Underage.....	2	50.0	0	0.0

⁷ Accelerated pupils are permitted to take additional studies, making it possible to advance more than one grade a year.

As in other classes in the schools, the percentage of gains is much greater than the percentage of losses. While the average percentage of gains is very much the same in the accelerated group and the elementary schools as a whole, it must be acknowledged that the percentage of losses is greater among the accelerated pupils. However, the numbers in the various age-for-grade groups—overage, normal age, and underage—are too small to give their statistics much value, and it is only in the group as a whole that the percentage of loss can be given much consideration. This percentage, 7.9, is twice as great as that for any age group in the elementary schools as a whole. To recapitulate, among a group of 63 accelerated children of various ages, distributed through the elementary grades, 38 were in good nutritional status in the fall, and 25 were underweight. Of the 38 up to the standard of weight, 3, or 7.9 per cent, fell to or below it during the year. Of the 25 underweight pupils, 11, or 44 per cent, came up to the standard.

Acceleration in the Junior High School.

In the junior high school there were two accelerated classes in the seventh and eighth grades, a total of 67 pupils.

TABLE VII.—*Correlation of nutrition and acceleration in junior high school.*

Age for grade.	Number of pupils.	Number underweight.	Per cent.
All ages.....	67	22	32.8
Overage.....	4	0	0.0
Normal age.....	40	12	30.0
Underage.....	23	10	43.4

Table VII shows that the percentage of underweight in these accelerated classes, 32.8, is greater than that in the junior high school as a whole, which is 23.8 per cent. The percentage of underweight among the underage pupils is considerably greater than among the normal age. The few overage children in the group are all up to the standard of weight.

As in the case of the elementary schools, the last weighing in the spring was compared with the first weighing in the fall. The result is given in Table VIII.

TABLE VIII.—*Nutritional changes from October to March among accelerated pupils in the junior high school.*

Age for grade.	Children gaining good nutritional status.		Children losing good nutritional status.	
	Number.	Per cent.	Number.	Per cent.
All ages.....	10	33.3	2	5.4
Overage.....	1	100.0	0	0.0
Normal age.....	5	33.3	2	8.0
Underage.....	4	28.5	0	0.0

In the various age groups the numbers are too small to be significant. The number of overage pupils is too few to be considered. Of the four overage pupils, only one was underweight in the fall, and that one came up to the standard.

Taken as a whole, however, the findings in this group are suggestive. Of these 67 pupils, 37 were in good nutritional status in the fall and 30 were underweight. Two of the 37, or 5.4 per cent, fell to or below the line between October and March; while of the 30 underweight in the fall, 10, or 33.3 per cent, came up to the standard. It may be noted that the percentage of those changing from a poor to a good nutritional status is less in the junior high school than in the elementary schools.

TABLE IX.—*Nutrition, age for grade, and acceleration in elementary and junior high schools.*

Classification.	Per cent underweight.
All pupils.....	22
Over-age-for-grade pupils.....	24
Under-age-for-grade pupils.....	27
Accelerated pupils.....	30

Summary.

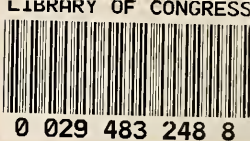
The work of the elementary grades apparently had little, if any, adverse effect on the pupils' weight. Of the children who entered the schools up to the standard of weight in the fall, remarkably few were under weight in March. This was entirely irrespective of the age of the pupil, the underage child making quite as good showing as the normal age or overage child.

There was a slightly larger amount of underweight among the overage children in the elementary schools, as well as a slightly larger average number of physical defects per child.

There was a large percentage of underweight among the underage children in the junior high school. Also there was a larger percentage of underweight among the bright children in the accelerated groups, both in the elementary and junior high schools, than among the other children.

As in the elementary schools, there was shown to be only a small percentage of change from a good to a poor nutritional status in the junior high school, from October to March, among the children doing regular grade work.

Acceleration in the elementary schools shows a larger percentage of change from good to poor nutritional status than does acceleration in the junior high school, or the regular grade work of either school. In the accelerated classes of the junior high school similar changes



are less than among the accelerated pupils in the elementary schools, but greater than among the children doing regular grade work. It must be remembered, however, that a much larger number of accelerated children should be studied in order to arrive at results which might be considered as in any way definitely conclusive.

Conclusions.

In view of the data summarized above, it is evident that at least tentative answers may be given to the questions which furnished the motive for this investigation and which have been stated in the beginning of the report. It must be remembered, however, that the number of pupils studied is somewhat limited, and that the findings apply to the particular school system studied. It is to be hoped that other investigators will pursue studies similar to this one in order that additional evidence on these important subjects may be forthcoming.

1. Since it was shown quite definitely that few of the children who were up to the standard of weight on entering the elementary schools in the fall were below that standard six months later, and that this was true irrespective of the age of the pupil, it follows that parents need not hesitate to send a healthy child to school at the age of 6, which was the entrance age of the schools studied. It seems plain that school life, apart from detrimental influences which may exist in the home environment, is not ordinarily a menace to the child's state of nutrition.

2. As acceleration in the elementary schools shows a larger percentage of change from a good to a poor nutritional status than does acceleration in the junior high school, or the regular grade work of either school, it would seem that caution should be observed in accelerating young children—those of the elementary school age. At the junior high school age this need is not so evident, although it apparently exists to some extent.

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